

- Troughton, E., 1954. Furred Animals of Australia. (Fifth (revised) Edition). Sydney.
- Waterhouse, G. R., 1841. The Natural History of Marsupialia or Pouched Animals. Naturalist's Library (Jardine). Mammalia Volume 11. (Edinburgh).
- Waterhouse, G. R., 1846. A Natural History of the Mammalia, Vol. 1, containing the Order Marsupialia, or Pouched Animals. (London).
- Whittell, H. M. 1942-1951. A Review of the Work of John Gilbert in Western Australia. Part II, *Emu*, vol. 41, pp. 216-242; Part IV, *Emu*, vol. 51, pp. 17-29.

KEY TO THE FROGS OF SOUTH-WESTERN AUSTRALIA

By A. R. MAIN, Zoology Department, University of W.A.

INTRODUCTION

The most recent paper dealing with Western Australian frogs is Parker's (1940) treatment of the Australian Leptodactylidae. The same author, in a brief paper (Parker, 1938) discussed some of the local Hylidae, and Loveridge (1935) included Western Australian species of both families in his list of Australian frogs at Harvard.

The above papers, based on preserved specimens, are strictly taxonomic; they depend solely on the technique of comparative morphology in establishing species and thus are largely outside the scope of techniques available to field workers. We are at present engaged, in the Zoology Department, in a long term investigation of the systematics and biology of local frogs and it is apparent that new species will need to be erected.

Parker's paper is out of print and until our larger study revising genera is ready for the press this key to the species listed by Parker is issued as an aid to identification in the field. The accompanying illustrations are copied from photographs of live animals and have been selected as portraying the characteristic attitude of the various species when viewed dorsally. The drawings are not to scale but dimensions are given under each species description.

It is always preferable to give detailed distributions by listing localities at which specimens have been collected but such a procedure would make this paper too long for its purpose. So as a compromise only the generalised range of the species is given.

The geographic limits of South-western Australia, for the purpose of this paper, are taken as Western Australia south of the Tropic of Capricorn.

KEY

1. Toes and fingers with sticky terminal pads or discs
 (Hylidae) 2
 Above absent 5
2. Colour on dorsal surface uniform i.e. no pattern 3
 Conspicuous pattern, usually green and gold 4

3. Silver grey to pale brown dorsally and having bright red spots on posterior of thigh *Hyla adelaidensis*
 Reddish brown dorsally, laeks red spots on thighs (as far south as Murehison River) *Hyla rubella*
4. Large speeies, brilliant pattern of green and gold dorsally, laeks black on ventral surfaee and thighs *Hyla aurea*
 As above but having prominent blaek and yellow marks on thighs and groin *Hyla cyclorhynchus*
5. 'Typieal' frogs 6
 Not as above, having very small head and extremely short limbs. Looks like a Turtle and lives always beneath soil surfaee *Myobatrachus gouldii*
6. Large speeies having a "shovel," see Fig. 1, on the heel of foot, all eapable of burrowing 7
 Small to very small speeies, without "shovel" on foot. Aquatic or eryptozoie 10
7. Dorsum rough or warty with a pattern of warts or blotehes 8
 Dorsum rough, if pattern present then not distinet, usually mottled, never having red on any part of body 9
8. Yellow mid-dorsal line, leg with prominent swollen gland, red in groin and on thigh *Lymnodynastes dorsalis*
 Yellow dorsal line and two lateral yellow lines, one from above tympanum to flank and the other running parallel to mid-dorsal line *Helioporus wilsmorei*
 Dorsum warty to almost smooth, with very variable pattern of brown to golden blotehes, flanks often bright yellow, some speeimens with a red dorsal stripe. Leg never with swollen gland or red markings.
 *Helioporus pelobatoides*
 *Helioporus centralis*
9. Purple brown dorsally, flanks with small golden yellow spots. Burrowing forms in elayey soils. ♂ with spines on 'thumb' in breeding season ... *Helioporus australiacus*
 Brown to grey dorsally and having large eream or white spots on dorsum and flanks. Burrows in sandy areas, east of Darling Searp. ♂ having spines on thumb in breeding season *Helioporus albopunctatus*
 Brown to mottled grey above sometimes with yellow bloteh on snout and yellow smudge above each shoulder (espeeially in juveniles). Burrows in sand on eoastal region and in sandy valleys in Darling Range *Helioporus eyrei*
10. Frogs with webbed toes. Reddish brown dorsally, having flat red-brown warts from behind eyes and along flanks ending with two large orange-red blotehes each side of urostyle *Glauertia russelli*
 Feet not webbed 11



PLATE 1

Fig. 1—Foot with 'shovel'.

Fig. 2—*Helioporus wilsmorei*.

Fig. 3—*Myobatrachus gouldii*.

Fig. 4—*Hyla adalaidensis*.

Fig. 5—*Metacrinia niehollsi*.

Fig. 6—*Limnodynastes dorsalis dorsalis*.

Fig. 7—*Crinia leui*.

Fig. 8—*Helioporus centralis*.

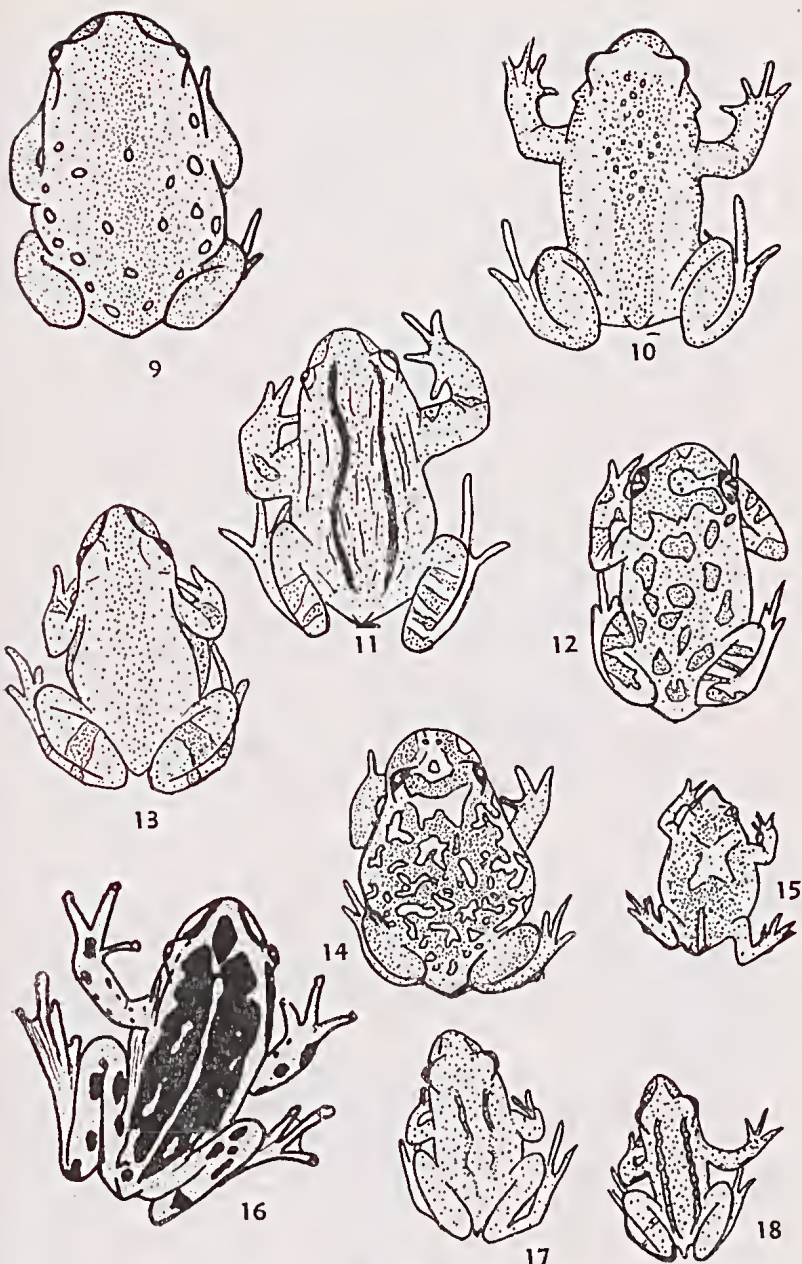


PLATE 2

- Fig. 9—*Helioporus albopunctatus*. Fig. 14—*Helioporus eyrei*.
 Fig. 10—*Crinia rosea*. Fig. 15—*Pseudophryne guentheri*.
 Fig. 11—*Crinia georgiana*.
 Fig. 12—*Helioporus pelobatooides*. Fig. 16—*Hyla aurea*.
 Fig. 13—*Crinia signifera*. Figs. 17 & 18—*Crinia glauerti*,
 showing variation.

11. No ear drum, reddish brown to grey dorsally. Sometimes with 'X' above shoulders always with light or reddish streak above urostyle. Walks on tip-toe, rarely hops *Pseudophryne guentheri*
P. occidentalis
 Having ear drum (sometimes indistinct) 12
12. Ventral surface blue with prominent yellow or orange blotches. Walks *Metacrinia nichollsi*
 Not as above 13
13. Ventral surface pink or red *Crinia rosea*
 Not as above 14
14. Groin and thigh flamed in bright red, hands without pigment, eyelid yellow or golden. Dorsum may be smooth, red, grey or black, ridged or warty *Crinia georgiana*
 Not as above 15
15. Dorsum smooth and without warts or ridges, dark triangular interorbital mark sometimes extending whole length of back. Dorsum and flank often with small scattered blue-white spots. Legs very long (longer than body) *Crinia leai*
 Dorsum smooth to rough and warty, grey to bisuit brown, hands dark and pigmented. Call; Crk, Crk, Crk *Crinia signifera*
 Dorsum rough and warty to dark and smooth with longitudinal ridges and yellow and red streak on each flank. Call, prolonged rattle. The smallest of the Crinias *Crinia glauerti*

Genus *HYLA* Laurenti

Hyla adelaidensis Gray

Type Locality: "Western Australia."

Range: The wetter parts of the South-west in the area of winter rainfall and following the coast near the limits of range. Collected as far east as Pine Hill (between Balladonia and Israelite Bay).

Description: Fig. 4. A long slender frog, length about 60 mm., usually pale fawn or brown dorsally having a much darker stripe commencing at the eye and running along each flank. The red spots on the thigh are characteristic and remain constant irrespective of dorsal colour.

Habitat: Reed-grown margins of swamps and lakes. Calls from water or soil level up to as high as three feet while hanging on the reeds.

Hyla rubella Gray

Type Locality: Port Essington, N.T.

Range: From about the Murchison River inland and northward to include the whole of northern Western Australia.

Description: A small stout frog, about 30 mm. long, reddish brown or dull grey-brown dorsally. Broader and shorter than *adelaidensis* and lacks spots on thigh.

Habitat: Found wherever there is relatively permanent fresh water; in the event of drought the animals survive for some time beneath debris.

Hyla aurea Lesson

Hyla aurea raniformis (Keferstein)

Type Locality: "Australia."

Range: The coastal and wetter parts of the South-west in the same general situations as *H. adelaidensis*. Somewhere east of Cheyne Beach and west of Jarramongup this species is replaced by *H. cyclorhynchus*.

Description: Fig. 16. When full grown a large stout frog, up to 80 mm. long, capable of marked colour changes, in sunlight generally green and gold, in darkness or cold may be dull brown. Lacks the black and sulphur markings in groin and thigh which is characteristic of *cyclorhynchus*. Generally has mid-dorsal stripe.

Habitat: Swamps and lakes, also along vegetated margins of streams. In undisturbed situations can be frequently found up paper bark trees and swamp gums. In disturbed conditions such as boggy pastures, drains and creeks through pastures it becomes a frog of the grass.

Hyla cyclorhynchus Boulenger

Type Locality: "Western Australia."

Range: As already mentioned under *H. aurea* this form extends along the southern coast, and has been taken as far east as Pine Hill.

Description: As large as *H. aurea* and appears to differ from this species mainly in the black and sulphur markings in groin and on thigh. Dorsally has a pattern of green blotches, and lacks the mid-dorsal stripe usually found in *aurea*.

Habitat: Swamps and permanent waters. At Hopetoun it is commonly found in rain water tanks.

Genus *MYOBATRACHUS* Schlegel

Myobatrachus gouldii (Gray)

Type Locality: "Western Australia."

Range: From about Geraldton in the north to Stirling Ranges in the South-east.

Description: Fig. 3. A stout leaden grey frog having a very small head and extremely short limbs. Body up to 45 mm. long.

Habitat: This appears to be a truly subterranean frog and it is only by accident that it is found. Some specimens have been dug up, others disclosed when rolling rotten logs. The animal appears to eat termites.

Genus *LIMNODYNASTES* Fitzinger

Limnodynastes dorsalis (Gray)

L. dorsalis dorsalis (Gray)

Type Locality: "Western Australia."

Range: Throughout the South-west in the area of winter rainfall from about Northampton in the north to Pine Hill in the South-east.

Description: Fig. 6. Mature specimens may be up to 75 mm. long. The dorsal stripe to which the specific name is an allusion is invariably present. The red in the groin is constant and with the large gland on the leg of mature animals is always diagnostic.

Habitat: Swamps with permanent water and along swampy stream banks. Throughout the Western wheatbelt it is common in dams and water catchments.

Genus *HELIOPORUS* Gray

Helioporus wilsmorei Parker

Type Locality: Wurarga, W.A.

Range: North and east of a line drawn from the coast north of Geraldton through Morawa to Lakeside, i.e. the dryer and interior part of the State.

Description: Fig. 2. A large stout chocolate brown frog up to 60 mm. long having bright yellow or golden stripes dorsally as follows: commencing over the shoulder on each side one stripe running along the back, beginning at the same spot a second stripe occurs. These run backward and downward to each flank. Feet with digging shovel (see Fig. 1). Male in breeding season with a pad on thumb.

Helioporus pelobatoides Werner

Type Locality: Beverley and Broomehill, W.A.

Range: From Caversham through Wubin and southward to the Stirling Ranges. In the north the species merges into the range of *centralis*.

Description: Fig. 12. A variable frog as indicated in the key. Smaller than *H. centralis* up to 45 mm. long, but small *centralis* are only separable from *pelobatoides* by geography. Male in breeding state having a roughened back and dark rough pad on the thumb and first finger of the hand.

Habitat: A burrowing species not met with in the summer but common when the first rains occur.

Helioporus centralis Parker

Type Locality: 100 miles east of Lake Eyre.

Range: Murchison River, Morawa, Yalgoo, Bunjil via Caron, and northward and eastward of these localities.

Description: Fig. 8. Variable as *pelobatoides* but a little larger, up to 55 mm. long. Male at breeding having black roughened pad on thumb and first finger.

Habitat: Not known; is a burrower and appears great distances from water.

Helioporus australiacus (Shaw)

Type Locality: "New Holland." (= County of Cumberland, N.S.W.).

Range: The Darling Scarp and occasionally the clay zone to the west, to the east of the Scarp in areas of laterites and clays as far east as a line joining Baker's Hill and Kojonup. Bindoon is near the northern limit of the range.

Description: A very large frog, up to 80 mm. long. Chocolate-brown dorsally and having the flanks profusely spotted with bright yellow. Male in breeding season with one or two large spines on the thumb. In shape very like *albopunctatus*.

Habitat: Frequents clayey soils where it occupies shallow burrows beneath logs or rocks.

Helioporus albopunctatus Gray

Type Locality: "Western Australia."

Range: From about Geraldton in the north then southward through the sands of the eastern part of the Darling Range and Wheatbelt to Jarramongup in the south.

Description: Fig. 9. A large frog, much larger than *eyrei*, up to 70 mm. long, leaden grey dorsally and spotted with large cream spots. Head high and rounded, ♂ with spine on thumb.

Habitat: Creeks and swamps in the region discussed under range, digs irregular horizontal or vertical burrows in the sand. Eggs laid in the burrow.

Helioporus eyrei (Gray)

Type Locality: "On the banks of the river Murray" (W.A.).

Range: The coastal plain on the west and south coast in area of winter rainfall wherever it is sandy. Specimens have been obtained from as far east as Esperance and the species also occurs on Rottnest.

Description: Fig. 14. Smaller than either *albopunctatus* or *australiacus* up to 60 mm. long, leaden grey dorsally variously mottled in dirty white or light grey. Head flatter and snout more pointed than *albopunctata*.

Habitat: Swampy areas where the soil is sandy, they are sometimes found in the sandy valleys on the western side of the Darling Range. Eggs laid in a burrow in the sand.

Genus *GLAUERTIA* Loveridge

Glauertia russelli Loveridge

Type Locality: Creek flowing into the Gascoyne River near Landor Station.

Range: Known only from the type locality and from Weeli Wolli (Marillana Station) in the Hamersley Range.

Description: A stout frog up to 30 mm. long. Olive brown with orange-red blotches on shoulder and similar blotches extending irregularly along flanks. A pair of the same colour on each side of the anus.

Habitat: Reed-grown border of permanent water where the frog occurs beneath fallen stems of reeds.

Genus *PSEUDOPHRYNE* Fitzinger

Pseudophryne guentheri Boulenger

Type Localities: "Swan River, N.W. Australia, Australia."

Range: A very widespread and common frog from the Chapman River in the north through the wetter part of the Wheatbelt to the far south coast.

Description: Fig. 15. A small flattened frog up to 30 mm. long with very variable markings, the constant character being a red streak above the coceyx. The dorsum may be grey or brown, warty or smooth, with a mottled pattern which sometimes looks like an X above the shoulders. Belly marked in black and white.

Habitat: A cryptozoic frog. Occurring in damp situations beneath rocks and litter or under fallen timber or dead grass.

Pseudophryne occidentalis Parker

Type Locality: Bruce Rock.

Range: Inland from that of *P. guentheri*.

Description: Generally very similar in size and appearance to *P. guentheri* but lacking warty skin. Chocolate brown dorsally with orange stripe over coceyx, an arrow-shaped orange mark between eyes and along snout and upper part of fore and hind limbs orange. Belly boldly marked in black and white.

Habitat: Beneath fallen reeds and debris adjacent to permanent water.

Genus *METACRINIA* Parker

Metacrinia nichollsi (Harrison)

Type Locality: Pemberton.

Range: In the wet Karri forest from Manjimup to Pemberton, Augusta and Nornalup.

Description: Fig. 5. A small frog up to 25 mm. long with very blunt snout, usually very dark brown or almost black dorsally though some specimens may be rust-coloured dorsally. Ventrally blue with yellow or orange blotches usually at the base of each limb.

Habitat: Early specimens found appeared to be associated with sergeant ants (*Myrmecia* sp.) but specimens have been found in rotten logs of peppermint (*Agonis* sp.), beneath rotting logs of *Banksia* and crawling in deep wet forest litter.

Genus *CRINIA* Tschudi

Crinia rosea Harrison

Type Locality: Pemberton.

Range: The valley of the Warren River about Pemberton.

Description: Fig. 10. A small stout frog up to 25 mm. long having dorsal markings somewhat like *C. leai* but clearly distinguished by the rose pink under surface. Male at breeding with almost black throat.

Habitat: In tunnels beneath the moist vegetation along the fast-flowing tributaries of the Warren River.

Crinia georgiana Tschudi

Type Locality: King George's Sound.

Range: This species is recorded in the literature from as far north as Carnarvon but local collecting indicates that the species only extends north to the Broekman River thence the range covers the western part of the Darling Range southward to the south coast and then east along the coast.

Description: Fig. 11. A frog up to 40 mm. long with an extremely variable dorsal pattern varying from rough warty and grey to smooth and red-brown. The invariable characters are already mentioned in the key viz. the golden eyelid, unpigmented hands and red in the groin. Male in breeding dress with very dark throat.

Habitat: A forest frog, found in the wet Jarrah and Karri forests where surface water, apart from streams or swamps, abundant in winter.

Crinia leai Fletcher

Type Locality: Bridgetown and Pipe Clay Creek, Jarrahdale.

Range: That of *C. georgiana* except it does not extend along the south coast beyond Albany.

Description: Fig. 7. A light brown to dark brown frog up to 25 mm. long, having a broad black dorsal stripe which commences between the eyes and extends over whole dorsum. Frequently this stripe is eroded and the margins irregular. Many animals are profusely spotted dorsally with minute blue-white spots. Occasionally animals may have large irregular yellow blotches dorsally.

Habitat: This is a frog which favours cool shaded swampy places. In the north of its range it frequents deep naturally vegetated and shady streams, while in the south it is found in nearly every swamp and along every stream.

Crinia signifera Girard

C. signifera signifera Girard

Type Locality: New Holland.

Range: Including that of *georgiana* and *glauerti* but extending much further to the east, where it is common at most temporary waters and water holes where natural vegetation is still found.

Description: Fig. 13. May be almost the same size as *georgiana* but lacks the red in the groin, the golden eyelid, and has pigmented hands. Throat of male dark brown. Can readily be confused with *glauerti*, which is however probably a valid species.

Habitat: In swamps and along streams where it may occur with *C. leai* or in swamps and marshes with *glauerti*. In the Wheatbelt it is common at most temporary waters and water-holes where the natural vegetation is still found.

Crinia glauerti Loveridge

Type Locality: Mundaring Weir.

Range: Throughout the South-west.

Description: Figs. 17 and 18. This is the smallest crinia found in Western Australia, up to 20 mm. long, apart from its small size, it is extremely variable in colour and dorsal pattern. It lacks colour in the groin and the characteristic cyclid of *georgiana* and is usually too rough dorsally to be confused with *C. leai*. It may be confused with small or juvenile *C. signifera*. Throat of male dark.

Habitat: Swamps and marshy stream banks throughout the area of winter rainfall. This frog adapts very well to disturbance of natural conditions and is common in marshy pastures.

LITERATURE CITED

- Loveridge, A., 1935. Australian Amphibia in the Museum of Comparative Zoology Cambridge, Massachusetts. *Bull. Mus. Comp. Zool.* vol. LXXVIII, No. 1, pp. 1-60.
- Parker, H. W., 1938. The Races of the Australian Frog *Hyla aurea* Lesson. *Annals and Mag. Nat. Hist.* (Ser. 11), vol. 2, pp. 302-305.
- Parker, H. W., 1940. The Australian Frogs of the Family Leptodactylidae. *Novitates Zoologicae*, vol. 42, 1, pp. 1-106.

FROM FIELD AND STUDY

Tawny-crowned Honeyeater in Forest Country.—During February, March and early April, 1954, a large invasion of Tawny-crowned Honeyeaters (*Gliciphila melanops*) occurred in the Bailup-Wooroloo district. The birds were feeding in the tops of high marri (*Eucalyptus calophylla*) in flower. They were very active at dawn but not so noisy as they usually are in the sandplain country. They were rather shy but with some trouble a specimen was procured and positive identification established. This specimen, collected on March 7, was a bird of the year, having a small ovary and the skull incompletely ossified.

This occurrence links up the Wheatbelt habitat and that of the coastal sandplain.

—I. C. CARNABY, Bailup.

Aggressive Behaviour by Black-faced Wood-Swallows.—Several papers and notes have appeared recently concerning communal nesting among Australian birds so that the following incident relating to a group of Black-faced Wood-Swallows (*Artamus cinereus*) may be worth recording.

Near Mooliabennie on January 1, 1954, my attention was drawn to a nest of this species when the fully grown young "exploded" from a banksia bush as I passed by. On reaching down and picking up one of the nestlings no less than six adult Wood-Swallows began intimidatory dives "Stuka" fashion and kept up their attacks until I left the area. The whole community appeared to react to the danger to one of their number as if they themselves were directly concerned though a casual search later failed to reveal any other nests in the neighbourhood.

—JOHN WARHAM, Lecderville.